

KIT TA Status

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INSTITUT FÜR EXPERIMENTELLE TEILCHENPHYSIK



The infrastructure

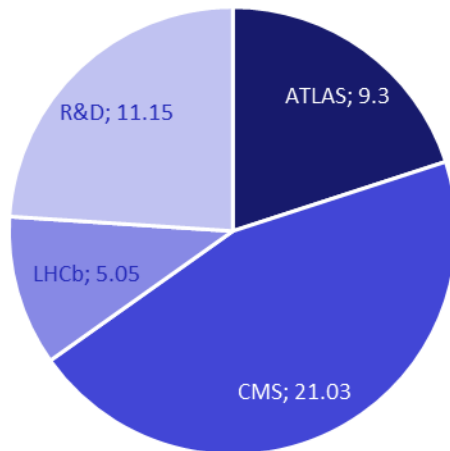
- Description on http://www.ekp.kit.edu/english/irradiation_center.php
- Cyclotron parameters:
 - Proton energy ~23 MeV (25.3MeV at extraction)
 - Proton current ~2.0 μ A (100nA - 20 μ A)
 - Max. object width 44cm
 - Max. object height 17cm
 - N₂-cooling temperature -30°C
- On average 4-5h slot every second week
 - up to 6 weeks turn-around time
 - after low access rate in 2017 back in normal operation
- E.g., irradiating one sensor of 20mm x 20mm to $5 \times 10^{15} \text{ n}_{1\text{MeV}}/\text{cm}^2$ takes about 90 minutes.
- Samples can be shipped to us, we irradiated and send them back
 - No visitors expected!
- Initial contact and infos: irradiations@lists.kit.edu

Projects so far

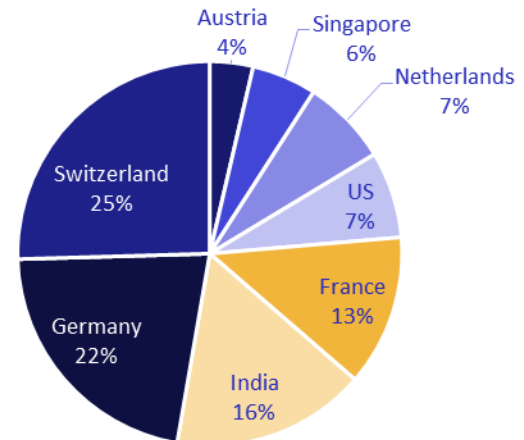
- Projects: 20 / 30
- Users: 75 / 90
- Access units: **46.5h** / 100h

- In preparation for 2018: ~15h ATLAS; ~10h CMS; ...

AUs per Community

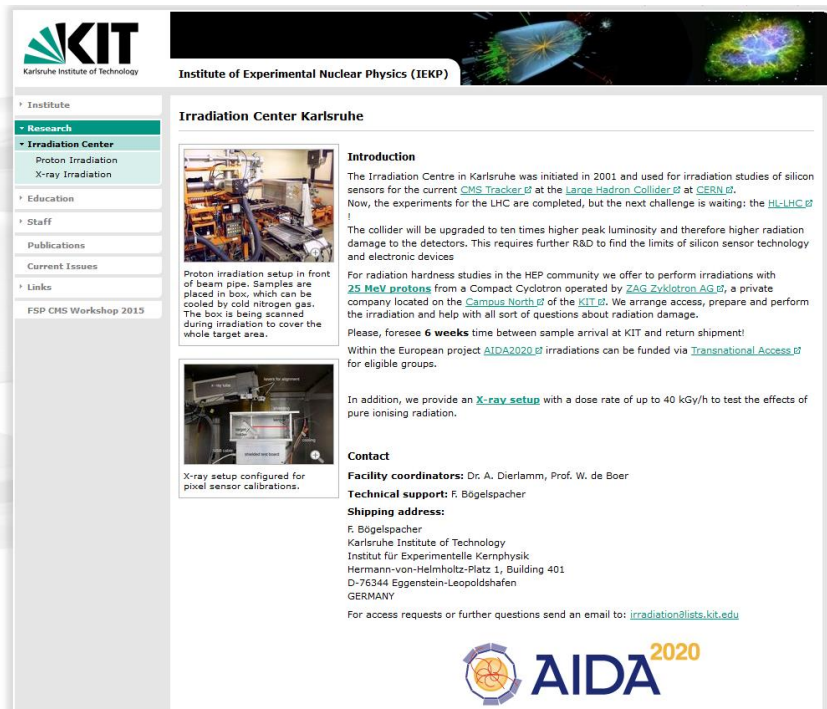


Home institutions



Publicity

- Dedicated web page
- Listed in <http://irradiation-facilities.web.cern.ch/publicDB.php>
- TA video online
- Personal reminders to previous customers



KIT
Karlsruhe Institute of Technology

Institute of Experimental Nuclear Physics (IEKP)

Irradiation Center Karlsruhe

Research Center
Proton Irradiation
X-ray Irradiation

Education
Staff
Publications
Current Issues
Links
FSP CMS Workshop 2015

Introduction

The Irradiation Centre in Karlsruhe was initiated in 2001 and used for irradiation studies of silicon sensors for the current [CMS Tracker](#) at the [Large Hadron Collider](#) at [CERN](#). Now, the experiments for the LHC are completed, but the next challenge is waiting: the [HL-LHC](#).

The collider will be upgraded to ten times higher peak luminosity and therefore higher radiation damage to the detectors. This requires further R&D to find the limits of silicon sensor technology and electronic devices.

For radiation hardness studies in the HEP community we offer to perform irradiations with **25 MeV protons** from a Compact Cyclotron operated by [ZAG Zyklotron AG](#), a private company located on the [Campus North](#) of the [KIT](#). We arrange access, prepare and perform the irradiation and help with all sort of questions about radiation damage.

Please, foresee **6 weeks** time between sample arrival at KIT and return shipment!

Within the European project [AIDA2020](#) irradiations can be funded via [Transnational Access](#) for eligible groups.

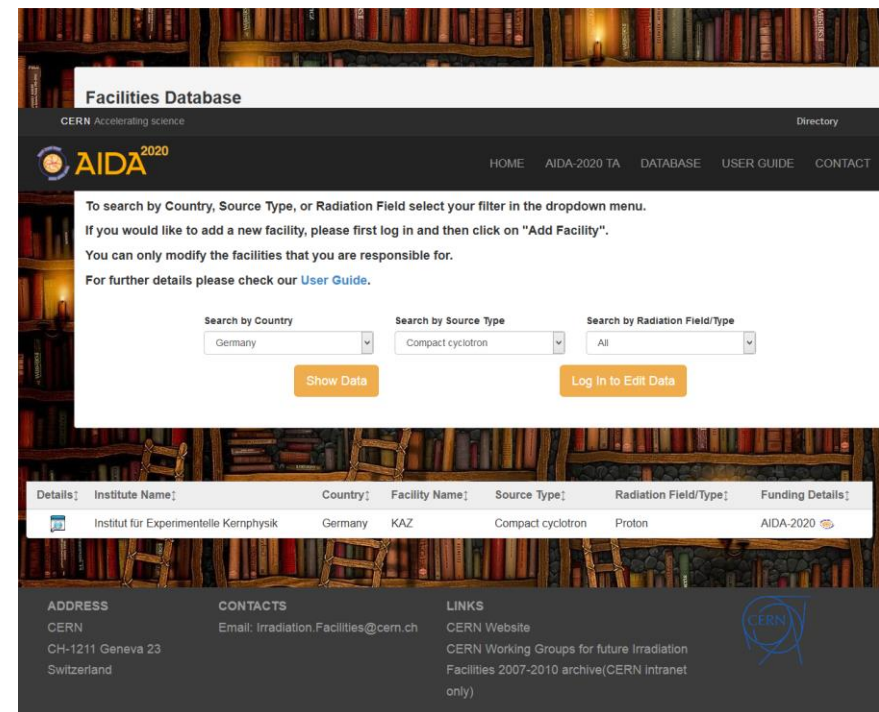
In addition, we provide an [X-ray setup](#) with a dose rate of up to 40 kGy/h to test the effects of pure ionising radiation.

Contact

Facility coordinators: Dr. A. Dierlamm, Prof. W. de Boer
Technical support: F. Bögelspacher
Shipping address:
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Karlsruhe Institute of Technology
Institut für Experimentelle Kernphysik
Hermann-von-Helmholtz-Platz 1, Building 401
D-76344 Eggenstein-Leopoldshafen
GERMANY

For access requests or further questions send an email to: irradiation@lists.kit.edu

AIDA 2020



Facilities Database
CERN Accelerating science

HOME AIDA-2020 TA DATABASE USER GUIDE CONTACT

To search by Country, Source Type, or Radiation Field select your filter in the dropdown menu.



If you would like to add a new facility, please first log in and then click on "Add Facility".

You can only modify the facilities that you are responsible for.

For further details please check our [User Guide](#).

Search by Country: Germany
Search by Source Type: Compact cyclotron
Search by Radiation Field/Type: All


Show Data Log In to Edit Data

Details	Institute Name	Country	Facility Name	Source Type	Radiation Field/Type	Funding Details
	Institut für Experimentelle Kernphysik	Germany	KAZ	Compact cyclotron	Proton	AIDA-2020 

ADDRESS
CERN
CH-1211 Geneva 23
Switzerland

CONTACTS
Email: Irradiation.Facilities@cern.ch

LINKS
CERN Website
CERN Working Groups for future Irradiation
Facilities 2007-2010 archive(CERN intranet only)



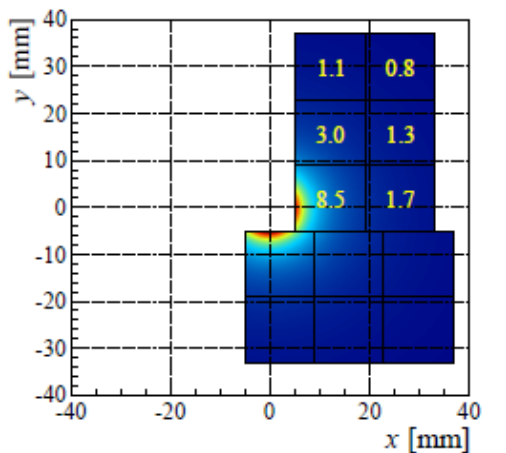
Publications

- Only few publications found; more announced by project leaders
 - keep asking...

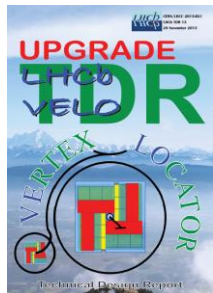
TA Project Acronym	Publication Year	Authors	Title	References
AIDA-2020-KIT-2015-04	2017	A. Starodumov	High rate capability and radiation tolerance of the new CMS pixel detector readout chip PROC600	2017 JINST 12 C01078
AIDA-2020-KIT-2016-10	2017	M. Meinhard, M. Backhaus, P. Berger and A. Starodumov	Performance of the modules for layer 1 of the CMS phase I pixel detector upgrade	CMS CR -2017/241
AIDA-2020-KIT-2016-05	2017	J. Lange et al.	Radiation hardness of small-pitch 3D pixel sensors up to HL-LHC fluences	arXiv:1707.01045
AIDA-2020-KIT-2015-01, AIDA-2020-KIT-2016-06, AIDA-2020-KIT-2017-03	2017	Folkestad et al.	Development of a silicon bulk radiation damage model for Sentaurus TCAD	NIM A 874 (2017) 94-102
AIDA-2020-KIT-2015-02	2017	M. Bomben et al.	Performance of active edge pixel sensors	J. Inst. 12 (2017) P05006

One Example

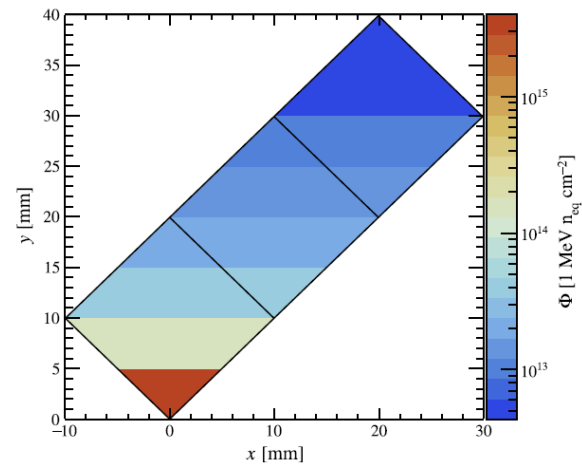
- Non-uniform irradiations for LHCb VELO
 - adapting the multiplicity of line scans we can approximate such radiation fields



Expected particle density in LHCb



Tile similar to irradiated objects



y [mm]	Fluence [1 MeV $n_{eq} cm^{-2}$]
0-5	4×10^{15}
5-10	1.57×10^{14}
10-15	3.47×10^{13}
15-20	1.73×10^{13}
20-25	1.30×10^{13}
25-30	8.68×10^{12}
30-50	4.34×10^{12}

Fig. 6. Non-uniform irradiation profile of a "triple" sensor irradiated at KIT to a maximum fluence of 4×10^{15} 1 MeV n_{eq}/cm^2 .

NIM A 874 (2017) 94-102

Performance data further used to develop simulation model

Conclusion

- Irradiations running smoothly (again)
- Very tedious to find/get publications from users
- Need to catch up providing AUs
 - new projects upcoming; actively looking for possible projects

SPARES

TA Project Acronym	Project Title	Communities involved (CMS,ATLAS, Neutrino...)	Continuation from previous reporting periods		Access Units
			Project completed (yes/no)	Date - when project completed	
AIDA-2020-KIT-2015-01	LHCb VELO upgrade	LHCb	yes	19 August 2015	2.13
AIDA-2020-KIT-2015-02	Irradiation of a LPNHE/FBK active edge pixel module	ATLAS	yes	11 August 2015	0.42
AIDA-2020-KIT-2015-03	Radiation-hard Si sensors development at India for the CMS Experiment	CMS	yes	16 November 2015	2.62
AIDA-2020-KIT-2015-04	Irradiation study of the CMS upgrade pixel detector readout chip	CMS	yes	12 May 2016	5.99
AIDA-2020-KIT-2015-05	Embedded Pitch Adapters		yes	10 December 2015	2.92
AIDA-2020-KIT-2016-01	High voltage sensor contacts in high radiation environment		yes	08 September 2016	1.22
AIDA-2020-KIT-2016-02	CMS tracker upgrade: front-side biasing with IFX sensor	CMS	yes	01 September 2016	5.43
AIDA-2020-KIT-2016-03	Finding a HV insulation for the future ATLAS strip tracker	ATLAS	yes	01 March 2017	1.67
AIDA-2020-KIT-2016-04	Radiation test for domain wall device		yes	08 September 2016	0.17
AIDA-2020-KIT-2016-05	Proton irradiation of a new generation of 3D sensors developed for the HL-LHC	ATLAS	yes	22 September 2016	2.62
AIDA-2020-KIT-2016-06	LHCb VELO upgrade	LHCb	yes	18 November 2016	1.92
AIDA-2020-KIT-2016-07	Investigation of radiation damage in CMS FPix sensors	CMS	yes	29 September 2016	4.08
AIDA-2020-KIT-2016-08	Study of Radiation hardness of small pixel Si sensors for CMS phase 2	CMS	no	-	-
AIDA-2020-KIT-2016-09	Radiation-hard Si sensors development at India for the CMS Experiment	CMS	yes	03 February 2017	0.08
AIDA-2020-KIT-2016-10	TID dependence study of a readback mechanism calibration of the CMS pixel readout chip	CMS	yes	25 January 2018	2.83
AIDA-2020-KIT-2017-01	Proton irradiation of AMS H35Demo chips	CMS	yes	28 April 2017	0.17
AIDA-2020-KIT-2017-02	Radiation hardness tests of small pitch, thin 3D sensor modules	CMS	yes	31 May 2017	5.33
AIDA-2020-KIT-2017-03	LHCb Velo Upgrade	CMS	yes	04 August 2017	1
AIDA-2020-KIT-2017-04	NitroStrip (RD50 project)	CMS	yes	12 October 2017	1.34
AIDA-2020-KIT-2018-01	Irradiation of a LPNHE/FBK/INFN thin and active edge pixel module	CMS	yes	25 January 2018	0.92
AIDA-2020-KIT-2018-02	Evaluation of the impact of irradiation on module components for the ATLAS Inner Tracker	ATLAS	yes	06 April 2018	3.67